PREVALENCE OF RESPIRATORY SYMPTOMS AMONG WORKERS EXPOSED TO WOOD DUST IN A WOODWORKING FACTORY

THESIS

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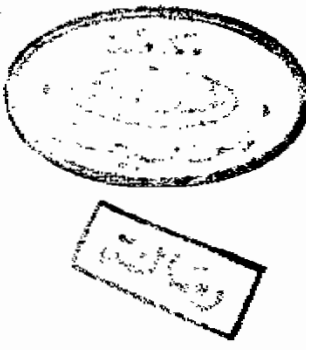

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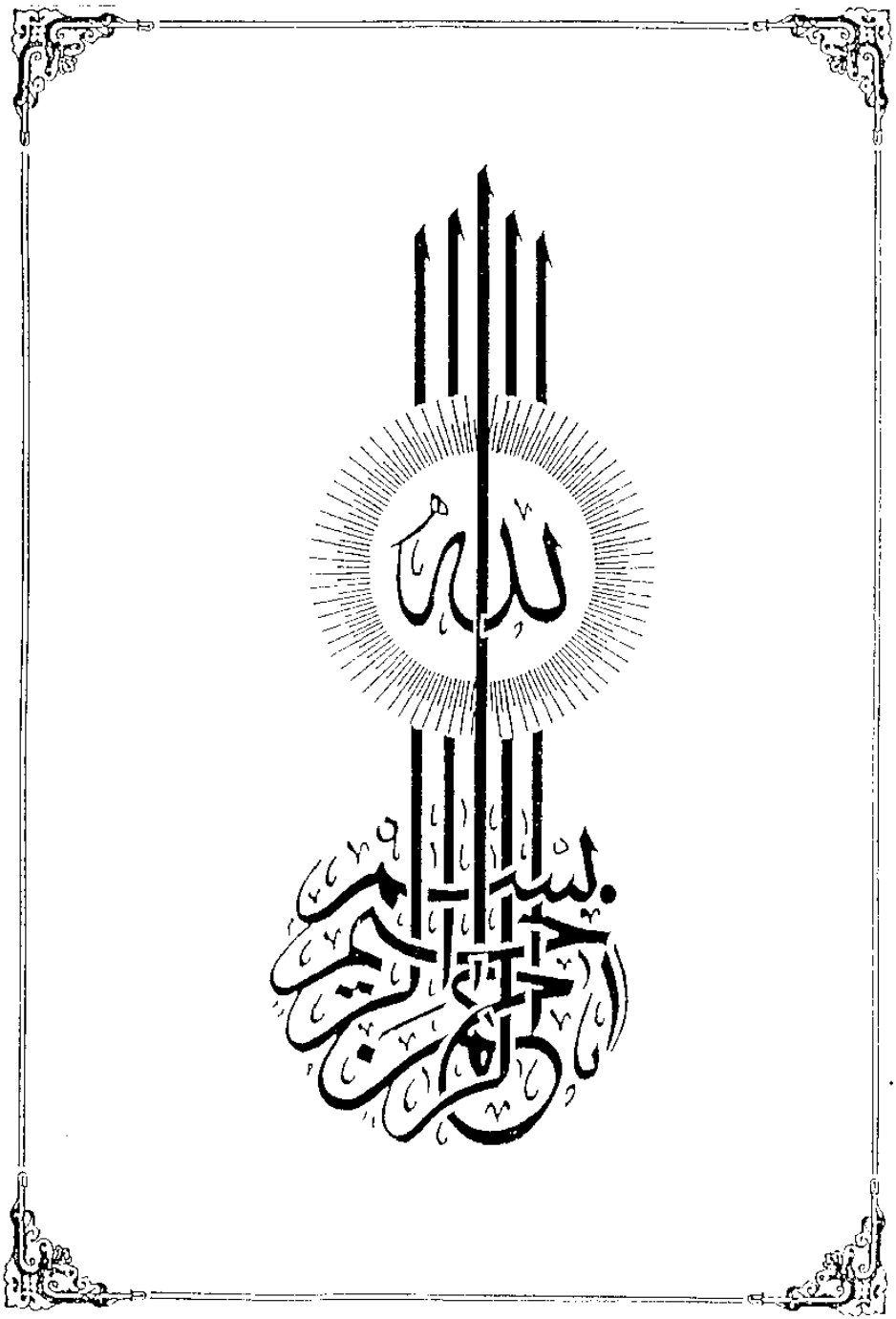

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INTRODUCTION

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The use of high speed saws and drills, which generate large quantities of very fine, respirable wood dust, including discrete but microscopic wood particles is thought to have significant potential health effects (Stellman and Garfinkel,1984).

The dusts of various woods, as well as other organic dusts, have come under increasing scrutiny in recent years regarding their health effects. Cotton dust and grain dust are two examples of organic dust on which a substantial health research effort has been expanded. Wood dusts are another type of organic dust exposure which can produce substantial health impacts.

Numerous case reports exist concerning skin reactions and obstructive respiratory changes pattern of either a hypersensitivity or irritant nature for various woods. Reports have also been published of apparently non-allergic obstructive respiratory effects including lung function test reductions and reduction of mucociliary clearance. Wood dust exposure also appears to be linked to the occurance of adenocarcinoma of the nasal sinuses.

Occasional reports linking wood dust to other types of cancer have been published. These relationships are much less consistent than the association with nasal cancer (Whitehead, 1982).

AIM OF THE STUDY

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The study is designed to determine whether workers exposed to wood dust differ from those non-exposed in the prevalence of respiratory symptoms and whether there are exposure -effect relationships between wood dust exposure and ventilatory function changes as determined by measuring the peak expiratory flow rate.

REVIEW OF LITERATURE

HEALTH EFFECTS OF WOOD DUST-RELEVANCE FOR PHYSICAL AND CHEMICAL STRUCTURE AND AIRBORNE DUST LEVELS

Wood varieties have been classified in three groups on the basis of their biological effects: poisonous or allergenic; biologically active; and biologically inactive or nearly so.

Numerous varieties of woods, particularly of tropical origin, are known to be potentially poisonous or biologically active, the most familiar of these are box, iroko, teak , pinus, red cedar and African mahogany.

The biological effects of wood give rise to many different morbid symptoms or processes, the nature of which depends on the quantity and composition of the constituent substances, which range from hydrocarbons to polycyclic compounds. In the first place, there are the primary irritating effects, inducing skin symptoms in persons working with green wood (dermatitis due to the direct action of wood on the skin, or inflammation of the tissues where splinters have entered the skin wounds), conjunctival irritation with inflammation, lacrimation and, occasionally, keratitis leading to disorders of vision; and irritation of the mucosae of the upper respiratory tract, with such initial symptoms as coughing

or hoarseness (chronic irritation produces atrophic changes in these tissues).

Next, there are the allergic conditions(rhinitis , asthma, or allergic skin disorders characterized by itching, follicular and bullous dermatitis, eczema and urticaria).

Wood dust has proved to be carcinogenic in the furniture and cabinet-making industry and an increased incidence of tumors has been suspected in the lumber and sawmill industries. Some studies suggest that the incidence of nasal cancer and Hodgkin's disease may be increased in the timber and sawmill industries. According to a few studies an increased risk of lung cancer and bladder cancer may exist for carpenters and joiners and for Hodgkin's disease for carpenters.

A variety of miscellaneous symptoms have been noted, such as nose bleeding, nausea, anorexia, vomiting, headache, weakness and vertigo.

Lung disorders, which are relatively rare, may take the form either of acute attacks accompanied by general symptoms (high fever, aching pains) or of chronic conditions displaying the characteristic signs of interstitial pulmonary fibrosis (Kadlec and Hanslian,1983).

A variety of respiratory disorders may develop within a matter of hours following the inhalation of agents encountered in the workplace. Their nature depends partly on the site predominantly involved, and partly on the type of reaction generated. Inertia chiefly dictates the site of deposition of inhaled particles. Particles with diameters exceeding 10 μ are almost all deposited by impaction on the mucosa of the upper respiratory tract. With particles of smaller sizes, increasing proportions enter the trachea. Those with the greatest weight tend to be deposited by impaction in the larger bronchi(where airflow is comparatively fast), while smaller and lighter particles tend to reach the alveoli to be deposited by sedimentation or diffusion. Large respirable particles (of 5-10 μ in diameter) are consequently more likely to induce reactions in the airways than in the gas exchanging tissues while small respirable particles (less than 1 μ in diameter) are more likely to induce reactions in the gas exchanging tissues (Hendrick and Weil ,1981).

Wood dust consists of small particles produced when wood is chipped, sawed, milled, shaped, planed, routed, drilled, turned or sanded. Typically, particles of wood dust are longer than they are broad or deep and differ widely in size,varying from the large ones created during boring, chipping, and sawing to the small ones generated during sanding of wood. The dust produced from hardwoods tends to consist of smaller particles

with a given method of production than that from softwoods. Particles with any dimension less than 10 μ occur rarely in wood dusts produced in other than sanding operations. Even in dust produced from hardwoods by machine sanding, comparatively few particles have any dimension smaller than 2 μ . About 25% of roughly spherical particles of this diameter have been found to be retained within the alveoli of the lungs after inhalation. More than 90% of spherical particles with diameters of 50 μ or more are deposited in the nose.

In addition to containing particles of various sizes, dusts from different woods vary in composition. Woods may contain such biologically active types of chemicals as alkaloids, saponines, aldehydes, quinones, flavonoids, tropolones, oils, cardiotoxic steroids, stilbenes, resins and proteins. Some of the important proteins that may occur in wood dusts come from fungi of the genera Alternaria, Aureobasidium, Cryptostroma, Graphium and Penicillium. Fungal proteins in wood dust may be in the form either of spores or fragments of hyphae. These proteins have been associated with pulmonary disease,characterized by increasingly sever dyspnoea associated with chills and fever, cough, malaise, headache and aching muscles and with dermatitis. Extrinsic chemicals such as pesticides and preservatives that may have been applied to wood, also may contribute to toxic effects from exposure to wood dusts (Wills, 1982).

Wood dust in machine shops and making shops in the furniture trade probably contain not only particles of wood but also on occasion, particles of silica and carborundum in the vicinity of sanding machines, and of glue where material is sawn after veneering. The presence of these is thought to be irregular for them to be of significance (Acheson et al., 1968).

Hanslian and Kadlec(1964) quoted by Whitehead (1982) reported levels of dust from wood grinding ave aging 40 mg/m^3 with a maximum of 200 mg/m^3. Ninety percent of the dust particles were less than five micrometers in size,determined optically after collection by Konimeter.They proposed three maximum allowable concentrations of ,1 mg/m^3,5 mg/m^3 and 10 mg/m^3 of respirable dust for toxic wood dust, biologically active types, and those with low biological action respectively.

Ruppe (1973) quoted by Whitehead (1982) as a part of a report documenting a range of irritative and respiratory symptoms and disorders in a group of 140 woodworkers using exotic woods, recommended a 5 mg/m^3 standard for these exotic woods to avoid allergic respiratory reactions. The data presented illustrated excess cough and expectoration, colds and sneezing, and mucosal irritation at exposures below 5 mg/m^3, but no excess at this level of exposure for sinusitis or for reduction in pulmonary function after an acetylecholine challenge,indicative of bronchial hyperreactivity.